JOURNAL OF DAIRY RESEARCH

EDITED BY

M. ELISABETH SHARPE, PH.D., D.SC., F.I.BIOL.
National Institute for Research in Dairying,
Shinfield, Reading, Berkshire, RG2 9AT

A. K. MARTIN, PH.D., A.R.I.C.
The Hannah Research Institute, Ayr, KA6 5HL

W. MANSON, PH.D.
The Hannah Research Institute, Ayr, KA6 5HL

Assistant Editors

A. T. ANDREWS, M.A., D.Phil.
B. F. BONE, B.A., A.L.A., A.I.Inf.Sc.
L. W. PHIPPS, B.Sc., Ph.D.

Editorial Assistant

MRS DOROTHY SKIDMORE

Secretary

J. C. F. COLES

VOLUME 45, 1978

CAMBRIDGE UNIVERSITY PRESS

PUBLISHED BY
THE SYNDICS OF THE CAMBRIDGE UNIVERSITY PRESS
The Pitt Building, Trumpington Street, Cambridge, CB2 1RP
Bentley House, 200 Euston Road, London, NW1 2DB
32 East 57th Street, New York, N.Y. 10022

© Proprietors of *The Journal of Dairy Research* 1978

Printed in Great Britain at the University Press, Cambridge

Contents

No. 1 (February 1978)

PAGE

The use of short-term secretion rate measurements for estimating the milk production of suckler cows. Y. L. P. Le Du, R. D. Baker and J. M. Barker 1

The cell count of milk in relation to milk yield. A. Meijering, F. H. J. Jaartsveld, M. W. A. Verstegen and M. J. M. Tielen 5

Bovine milk *N*-acetyl-β-D-glucosaminidase and its significance in the detection of abnormal udder secretions. B. J. Kitchen, G. Middleton and M. Salmon 15

Characteristic cell fragments in bovine milk. B. E. Brooker 21

Kinematic viscosities of New Zealand skim-milk. J. H. Buckingham . . 25

The effect of concentration on the heat stability of skim-milk. D. D. Muir and A. W. M. Sweetsur 37

The heat stability of milk and concentrated milk containing added aldehydes and sugars. C. Holt, D. D. Muir and A. W. M. Sweetsur 47

A heat-induced change in the ultrastructure of milk and its effect on gel formation in yoghurt. J. L. Davies, P. A. Shankar, B. E. Brooker and D. G. Hobbs 53

The reaction of α_{s1}- and β-casein with ferrous ions in the presence of oxygen. W. Manson and J. Cannon 59

Reductive methylation of lysine residues in casein. N. F. Olson, T. Richardson and J. G. Zadow 69

Recovery of whey proteins from precipitated complexes of carboxymethyl cellulose and protein. R. D. Hill and J. G. Zadow 77

The formation of complexes between whey proteins and carboxymethyl cellulose modified with substituents of increased hydrophobicity. J. G. Zadow and R. D. Hill 85

The uptake of amino acids and peptides by *Streptococcus lactis*. G. H. Rice, F. H. C. Stewart, A. J. Hillier and G. R. Jago 93

Antibacterial effect of the lactoperoxidase system on psychrotrophic bacteria in milk. L. Björck 109

Enrichment of zabadi with whey proteins. N. S. Ahmed and Azza A. Ismail 119

A comparison of the activity of *Lactobacillus bulgaricus* and one of its mutants in different types of milk. Jasjit Singh and B. Ranganathan . . 123

PAGE

The determination of lactose in milk: a comparison of gas–liquid chromatography with the Lane & Eynon method. S. Adachi and A. Yamaji . 127

Review of the progress of Dairy Science: antimicrobial systems in milk. Bruno Reiter 131

No. 2 (June 1978)

Heat stability of milk: influence of dilution and dialysis against water. P. F. Fox and C. M. Hearn 149

Heat stability of milk: influence of denaturable proteins and detergents on pH sensitivity. P. F. Fox and C. M. Hearn 159

Heat stability of milk: influence of κ-casein hydrolysis. P. F. Fox and C. M. Hearn 173

Seasonal changes in the heat stability of milk from creamery silos in south-west Scotland. C. Holt, D. D. Muir and A. W. M. Sweetsur . . 183

Preparation and fractionation of goat κ-casein: analysis of the glycan and peptide components. F. Addeo, S. Soulier, J.-P. Pelissier, J.-M. Chobert, J.-C. Mercier and B. Ribadeau-Dumas 191

Milk-fat globule membrane in homogenized cream. D. F. Darling and D. W. Butcher 197

The effect of diet on the γ- and δ-lactone and methyl ketone potentials of caprine butterfat. W. Stark, G. Urbach, L. J. Cook and J. R. Ashes 209

The effect of diet on the γ- and δ-lactone and methyl ketone potentials of bovine butterfat. G. Urbach and W. Stark 223

Metabolism of [^{14}C]bicarbonate by *Streptococcus lactis*: identification and distribution of labelled compounds. A. J. Hillier and G. R. Jago. . 231

Metabolism of [^{14}C]bicarbonate by *Streptococcus lactis*: the synthesis, uptake and excretion of aspartate by resting cells. A. J. Hillier, G. H. Rice and G. R. Jago 241

Lactostrepcins – acid bacteriocins produced by lactic streptococci. W. Kozak, J. Bardowski and W. T. Dobrzański 247

Effect of incubation temperature on the development of lactic acid bacteria and their phages. T. Sozzi, J.-M. Poulin and R. Maret 259

Formation of methanethiol by bacteria isolated from raw milk and Cheddar cheese. B. A. Law and M. E. Sharpe 267

Transport of purine bases by *Streptococcus lactis*. A. J. Hillier, G. H. Rice and G. R. Jago 277

PAGE

Persistence of foot-and-mouth disease virus in butter and butter oil. J. H. BLACKWELL 283

Proportion of B- and T-lymphocytes in normal bovine milk. C. CONCHA, O. HOLMBERG and B. MOREIN 287

Reviews of the progress of Dairy Science: reverse osmosis and ultrafiltration in dairying. F. A. GLOVER, P. J. SKUDDER, P. H. STOTHART and E. W. EVANS 291

No. 3 (October 1978)

The effect of supplementation of the diet of lactating Jersey cows with varying levels of acetic acid. C. L. JOHNSON and D. I. KITCHEN 321

Interrelationships between concentrations of acetylation and the disposal of acetyl groups in the livers of dairy cows. A. M. SNOSWELL, N. D. COSTA, J. G. MCLEAN, G. D. BAIRD, M. A. LOMAX and H. W. SYMONDS . . 331

Natural variations in the average size of bovine casein micelles. I. Milks from individual Ayrshire cows. C. HOLT and L. BAIRD 339

Natural variations in the average size of bovine casein micelles. II. Milk samples from creamery bulk silos in south-west Scotland. C. HOLT and D. D. MUIR 347

Natural variations in the average size of bovine casein micelles. III. Studies on colostrum by electron microscopy and light scattering. B. E. BROOKER and C. HOLT 355

An improved method for the preparation of crystalline β-lactose and observations on the melting point. T. ITOH, M. KATOH and S. ADACHI . . 363

Effects of mechanical agitation of raw milk on the milk-fat globule in relation to the level of induced lipolysis. H. C. DEETH and C. H. FITZ-GERALD 373

Storage of lactose-hydrolysed dried milk: effect of water activity on the protein nutritional value. A. BURVALL, N.-G. ASP, A. BOSSON, C. SAN JOSÉ and A. DAHLQVIST 381

Chemical analysis of flavour volatiles in heat-treated milks. H. A. JADDOU, J. A. PAVEY and D. J. MANNING 391

Intermicellar relationships in rennet-treated separated milk. I. Preparation representative electron micrographs. M. L. GREEN, D. G. HOBBS and S. V. MORANT 405

Intermicellar relationships in rennet-treated separated milk. II. Process of gel assembly. M. L. GREEN, D. G. HOBBS, S. V. MORANT and V. A. HILL 413

PAGE

The metabolism of [^{14}C]bicarbonate by *Streptococcus lactis*: the synthesis of succinic acid. A. J. Hillier and G. R. Jago 423

The metabolism of [^{14}C]bicarbonate by *Streptococcus lactis*: the fixation of [^{14}C]bicarbonate by pyruvate carboxylase. A. J. Hillier and G. R. Jago 433

Peptide hydrolases of *Lactobacillus casei*: isolation and general properties of various peptidase activities. M. El. Soda, M. J. Desmazeaud and J.-L. Bergère 445

Calorimetric identification of several strains of lactic acid bacteria. T. Fujita, P. R. Monk and I. Wadsö. 457

Proteolysis in Cheddar cheese: role of coagulant and starter bacteria. A. M. O'Keeffe, P. F. Fox and C. Daly 465

Cheddar cheese flavour studies. I. Production of volatiles and development of flavour during ripening. D. J. Manning 479

Effect of lipases on the ripening of Egyptian Ras cheese. M. H. Abd El-Salam, S. El-Shibiny, E. El-Bagoury, E. Ayad and N. Fahmy . . . 491

Development of volatile fatty acids in Ras cheese. S. El-Shibiny, M. A. Soliman, E. El-Bagoury, A. Gad and M. H. Abd El-Salam . . 497

Microflora of Cabrales cheese: changes during maturation. M. Nuñez . . 501

Production of cows milked 3 times each 2 days. G. A. Eldridge and J. Clark 509

Lactate dehydrogenases of *Streptococcus thermophilus*. E. I. Garvie . . 515

Detection and localization of peptide hydrolases in *Lactobacillus casei*. M. El Soda, J.-L. Bergère and M. J. Desmazeaud 519

Effects of main flow reversal in a simple homogenizing valve. L. W. Phipps . 525

Index of Subjects

Acetic acid, supplements, milk yield and composition, 321
Acetylation, acetate disposal, liver, 331
Agitation, milk, milk-fat globule damage, induced lipolysis, 373

Bacteria, *see also individual bacteria and types*
anti-systems, milk (review), 131
methanethiol-forming, isolated, milk, Cheddar cheese, 267
starter, *see* **Starter(s)**
Buffalo(es), milk, *Lactobacillus bulgaricus,* activity, 123
Butter, *see also* **Milk fat**
foot-and-mouth disease virus, persistence, 283
Butter oil, *see* **Dry butterfat**
Butterfat, *see* **Milk fat**

Cabrales cheese, ripening, microflora, changes, 501
Carboxymethyl cellulose, precipitation of whey proteins, 77, 85
Casein, micelles, rennet-treated separated milk, electron microscopy, 405
gel assembly, 413
size, colostrum, 355
milk, creamery silos, 347
individual cows, 339
α_s-Casein, reductive methylation, 69
α_{s1}-Casein, iron complexes, 59
β-Casein, iron complexes, 59
reductive methylation, 69
κ-Casein, fractionation, goat's milk, 191
hydrolysis, heat stability, milk, 173
reductive methylation, 69
Cell count, enzymic method, 15
milk yield, relationship, 5
Cell fragments, milk, 21
Cheddar cheese, bacteria from, methanethiol, formation, 267
flavour, volatiles, 479
proteolysis, coagulant, starter, role of, 465
Cheese ripening, Cabrales cheese, microflora, changes, 501
Ras cheese, effect of lipases, 491, 497
Chymosin, *see* **Rennin**
Coagulation, milk proteins, heated, κ-casein hydrolysis, influence, 173
concentrated skim-milk, 37
aldehydes, sugars, added 47
denaturable proteins, detergents, influence on pH sensitivity, 159
dilution, dialysis, against water, influence, 149
seasonal changes, S.W. Scotland, 183
Colostrum, casein micelles, size, 355
Cream, homogenized, milk-fat globule membrane, proteins, 197

Dairy industry, reverse osmosis, ultrafiltration (review), 291
Diet, acetic acid, addition, milk yield and composition, 321
lactone-, ketone-potentials, butterfat, cow, 223
goat, 209
Disease, *see also* **Mastitis**
foot-and-mouth, virus, persistence, butter, butter oil, 283
Dried milk, lactose-hydrolysed, storage, nutritional value, effect of water activity, 381
Dry butterfat, foot-and-mouth disease virus, persistence, 283

Enzymes, *see also individual enzymes*
measured, for estimation, cell content, milk, 15

Fatty acids, volatile, Ras cheese, ripening, 497
Flavour, Cheddar cheese, volatiles, 479
milk, volatiles, 391
Ras cheese, effect of lipases, 491
volatile fatty acids, development, 497

Goat(s), milk, κ-casein, fractionation, 191
Lactobacillus bulgaricus, activity, 123

Heat stability, *see* **Coagulation,** milk proteins, heated
Heat treatment, milk, flavour volatiles, analysis, 391
ultrastructure, change, 53
Homogenization, valve, effects of main flow reversal, 525

Iron complexes, α_{s1}-, β-caseins, 59

Ketones, butterfat, effect of diet, cow, 223
goat, 209

Lactate dehydrogenases, of *Streptococcus thermophilus,* 515
Lactic acid bacteria, and phages, growth temperature, 259
identification, calorimetric, 457
Lactobacillus bulgaricus, activity, milk, 123
L. casei, peptide hydrolases, 445, 519
Lactones, butterfat, effect of diet, cow, 223
goat, 209
Lactoperoxidase system, reduction, psychrotrophic bacteria, milk, 109
Lactose, milk, determination, methods, comparison, 127
β-Lactose, preparation, 363

Lactostrepcins, term for bacteriocins, produced, lactic streptococci, 247
Lipases, Ras cheese, ripening, flavour, 491
volatile fatty acids, development, 497
Lipolysis, induced, milk-fat globule, damage, agitation, 373
Liver, acetylation, acetate disposal, 331
Lymphocytes, B-, T-, milk, 287

Mastitis, diagnosis, cell count, enzymic method, 15
subclinical, milk, cell count, yield, relationship, 5
Milk, antimicrobial systems (review), 131
bacteria from, methanethiol formation, 267
casein micelles, size, 339, 347
cell count, enzymic method, 15
yield relationship, 5
cell fragments, 21
coagulation, *see* **Coagulation**
heated, flavour volatiles, analysis, 391
ultrastructure, change, 53
homogenization, valve, effects of main flow reversal, 525
Lactobacillus bulgaricus, activity, 123
B-, T-lymphocytes, 287
psychrotrophic bacteria, reduction, lactoperoxidase system, 109
Milk composition, acetic acid, added to diet, 321
lactose content, determination, 127
Milk fat, globule, damage, induced lipolysis, agitation, 373
membrane, proteins, homogenized cream, 197
lactones, ketones, effect of diet, cow, 223
goat, 209
Milk powder, *see* **Dried milk**
Milk proteins, *see also* **Whey proteins**
breakdown, *see* **Proteolysis**
heat stability, κ-casein hydrolysis, influence, 173
concentrated skim-milk, 37
aldehydes, sugars, added, 47
denaturable proteins, detergents, influence on pH sensitivity, 159
dilution, dialysis, against water, influence, 149
seasonal changes, S.W. Scotland, 183
milk-fat globule membrane, homogenized cream, 197
nutritional value, lactose-hydrolysed dried milk, effect of water activity, 381
Milk secretion, rate, suckler cows, 1
Milk yield, acetic acid, added to diet, 321
cell count, relationship, 5
reduced frequency, milking, 509
suckler cows, secretion rate, measurements, 1
Milking, reduced frequency, milk yield, 509
Moisture, content, lactose-hydrolysed dried milk, stored protein, nutritional value, 381

New Zealand, skim-milk, viscosity, 25

Pepsin, proteolysis, Cheddar cheese, 465
Peptide hydrolases, of *Lactobacillus casei*, 445, 519
pH, milk protein, heat stability, 159
Proteins, *see* **Milk proteins, Whey proteins**
Proteolysis, Cheddar cheese, 465
Psychrotrophic bacteria, milk, reduction, lactoperoxidase system, 109
Pyruvate carboxylase, fixation, bicarbonate, *Streptococcus lactis*, 433

Ras cheese, ripening, flavour, effect of lipases, 491
volatile fatty acids, development, 497
Rennet, -treated, separated milk, casein micelles, electron microscopy, 405
gel assembly, 413
Rennin, proteolysis, Cheddar cheese, 465
Reverse osmosis, ultrafiltration, dairying (review), 291

Scotland, S.W., milk, casein micelles, size, 347
heat stability, seasonal changes, 183
Separated milk, *see* **Skim-milk**
Skim-milk, concentrated, heat stability, 37
aldehydes, sugars, added, 47
rennet treated, inter-micellar relationships, 405, 413
viscosity, 25
Starter(s), proteolysis, Cheddar cheese, 465
Storage, lactose-hydrolysed dried milk, nutritional value, effect of water activity, 381
Streptococci, lactic, bacteriocins, 247
Streptococcus lactis, amino acids, peptides, uptake, 93
bicarbonate metabolism, 231
aspartate, 241
pyruvate carboxylase, 433
succinate synthesis, 423
purine bases, transport, 277
S. thermophilus, lactate dehydrogenases, 515

Ultrafiltration, reverse osmosis, dairying (review), 291

Virus, foot-and-mouth disease, persistence, butter, butter oil, 283
Viscosity, skim-milk, 25

Whey proteins, precipitation by carboxymethyl cellulose, 77, 85
zabadi, enrichment, 119

Yoghurt, gel formation, heated milk, 53

Zabadi, enrichment, whey proteins, 119

Index of Authors

Abd El-Salam, M. H., 491, 497
Adachi, S., 127, 363
Addeo, F., 191
Ahmed, N. S., 119
Ashes, J. R., 209
Asp, N.-G., 381
Ayad, E., 491

Baird, D., 331
Baird, L., 339
Baker, R. D., 1
Bardowski, J., 247
Barker, J. M., 1
Bergère, J.-L., 445, 519
Björck, L., 109
Blackwell, J. H., 283
Bosson, A., 381
Brooker, B. E., 21, 53, 355
Buckingham, J. H., 25
Burvall, A., 381
Butcher, D. W., 197

Cannon, J., 59
Chobert, J.-M., 191
Clark, J., 509
Concha, C., 287
Cook, L. J., 209
Costa, N., 331

Dahlqvist, A., 381
Daly, C., 465
Darling, D. F., 197
Davies, F. L., 53
Deeth, H., 373
Desmazeaud, M. J., 445, 519
Dobrzański, W. T., 247
Du, Y. L. P., Le, 1

El-Bagoury, E., 491, 497
Eldridge, G. A., 509
El-Shibiny, S., 491, 497
El Soda, M., 445, 519
Evans, E. W., 291

Fahmy, N., 491
Fitz-Gerald, C. H., 373
Fox, P. F., 149, 159, 173, 465
Fujita, T., 457

Gad, A., 497
Garvie, E. I., 515
Glover, F. A., 291
Green, M. L., 405, 413

Hearn, C. M., 149, 159, 173
Hill, R. D., 77, 85
Hill, V. A., 413
Hillier, A. J., 93, 231, 241, 277, 423, 433
Hobbs, D. G., 53, 405, 413
Holmberg, O., 287
Holt, C., 47, 183, 339, 347, 355

Ismail, A. A., 119
Itoh, T., 363

Jaartsveld, F. H. J., 5
Jaddou, H. A., 391
Jago, G. R., 93, 231, 241, 277, 423, 433
Johnson, C. L., 321

Katoh, M., 363
Kitchen, B. J., 15
Kitchen, D. I., 321
Kozak, W., 247

Law, B. A., 267
Le Du, Y. L. P., 1
Lomax, M. A., 331

McLean, J. G., 331
Manning, D. J., 391, 479
Manson, W., 59
Maret, R., 259
Meijering, A., 5
Mercier, J.-C., 191
Middleton, G., 15
Monk, P. R., 457
Morant, S. V., 405, 413
Morein, B., 287
Muir, D. D., 37, 47, 183, 347

Nuñez, M., 501

O'Keeffe, A. M., 465
Olson, N. F., 69

Pavey, J. A., 391
Pelissier, J.-P., 191
Phipps, L. W., 525
Poulin, J.-M., 259

Ranganathan, B., 123
Reiter, B., 131
Ribadeau-Dumas, B., 191
Rice, G. H., 93, 241, 277
Richardson, T., 69

Salmon, M., 15
San José, C., 381
Shankar, P. A., 53
Sharpe, M. E., 267
Singh, J., 123

Skudder, P. J., 291
Snoswell, A. M., 331
Soliman, M. A., 497
Soulier, S., 191
Sozzi, T., 259
Stark, W., 209, 223
Stewart, F. H. C., 93
Stothart, P. H., 291
Sweetsur, A. W. M., 37, 47, 183
Symonds, H. W., 331

Tielen, M. J. M., 5

Urbach, G., 209, 223

Verstegen, M. W. A., 5

Wadsö, I., 457

Yamaji, A., 127

Zadow, J. G., 69, 77, 85